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A MILK-BORNE OUTBREAK OF TYPHOID FEVER.[1]

ASSOCIATED WITH A CHRONIC AND A NORMAL OR CONTACT CARRIER OF B. TYPHOSUS.

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Since first demonstrated by Conradi and Drigalski, many observers have shown that some individuals exposed to infection subsequently excrete typhoid bacilli in their stools without developing any symptoms of disease. These persons are termed normal or contact carriers. Probably they are mostly temporary carriers. Some undoubtedly become chronic carriers, as evidenced by the existence of chronic carriers with no history of typhoid fever, although many without such history may well have had mild and, therefore, overlooked or forgotten infection.

The interest in the milk-borne outbreak that we report is that a normal or contact carrier and a chronic carrier were found on one of the farms supplying the milk and the former was at first assumed to be the source of the infection.

The facts concerning the outbreak are briefly as follows: Eleven cases of typhoid fever were directly traced to milk from the "B" dairy. Two additional cases were probably infected from the same source. The dates of onset of the cases extended from October 15 to November 16. This dairy distributed about 880 quarts of milk a day, obtaining its supply from six farms. About 160 quarts of the milk from one farm was distributed as "Baby's milk."

The milk received at the dairy was bottled and placed in ice boxes in the order of the numbers given to the farms supplying the milk. An exception was the "Baby's milk," a late afternoon milking, which was usually bottled on its arrival in the freshly sterilized bottling apparatus.

When the drivers started out in the morning, driver "Peter" took his supply first and usually took nearly all of the milk of farm No. 1. The other drivers then took their supply in the order of the farms given. All took their share of "Baby's milk," but "Peter" took as much as the other three drivers together.

All the cases of typhoid fever were on Peter's route, which is explained by his supply coming exclusively from Farm No. 1, the

[1] The authors are indebted to the Board of Health of Morristown, N. J., for the opportunity of studying this outbreak and for permission to report the results.

source of the infection, as subsequently determined. The contamination of the bottling tank by this milk was evidently not marked, as the milk subsequently bottled was not infectious.

One case of typhoid fever was a child 1½ years of age who, it was claimed, received "Baby's milk" only. As the only mark of identification was a penciled "B" on the cap, accidental substitution of bottles of the ordinary milk was easily possible and probably occurred in this case. The driver, Peter, had worked in the dairy for years, and denied all illness both of himself and members of his family.

All the farms were inspected and blood and feces obtained of all individuals at the farms as well as of those working in the dairy. All examinations were negative except of the specimens of two men on Farm No. 1, S. M. and L. M. The data on these two men at the time of the investigation is as follows:

S. M., employed at the dairy for three months, denies ever having had typhoid fever. Widal reaction November 12, suspicious; fecal examinations, November 17, negative; November 26, negative.

L. M., employed for four months, gives no history of having had typhoid fever. Widal reaction, November 12, negative. Fecal examinations, November 17, positive; December 2, negative.

The above findings, coupled with the mode of distribution of the milk, seemed to us conclusive evidence as to the source of the infection. This deduction, however, was shown by subsequent events to be erroneous. Although we were not quite satisfied with the Widal result in S. M., the two negative fecal examinations seemed to indicate that the slight Widal reaction was probably due to an exceptionally high content in normal agglutinins, a not infrequent finding.

The carrier L. M. left the farm, but we were able to locate him and examined further fecal specimens for a period of six months, none of which was positive. A most rigid inquiry of both L. M. and of his parents failed to elicit any history of an illness which could be considered typhoidal in character.

The helper S. M. left the farm about the same time but returned to work in February. In March we were notified that two cases of typhoid fever had developed, both children receiving milk directly from Farm No. 1, the milk not passing through the dairy. The fact that S. M. had returned and his previous Widal record raised our suspicions at once. A fecal examination revealed the presence of typhoid bacilli. Four other cases were subsequently reported, all attributable to milk from Farm No. 1. The absence of S. M. and not the exclusion of L. M. was the reason that no cases had occurred after the resumption of distribution by the dairy following our investigation.

We believe the following to be the interpretation of these unusual findings. The Widal reaction of S. M. indicates that he was a chronic

bacillus carrier, but at the time of our investigation was excreting no bacilli or too few to be found by the bacteriological methods employed. Later, on his return, he was excreting bacilli more freely and no difficulty was encountered in isolating them. He then disappeared and we could not observe him further. L. M. was a transient normal carrier infected by the milk or more probably through contact with S. M.

We were in error, therefore, because the carrier first found was a normal carrier, a fact unsuspected at the time. The presence of such a carrier raises interesting possibilities. Had we relied wholly upon the Widal reaction for the selection of fecal specimens and had S. M. given positive fecal results at the time, we would have excluded him and agreed to the resumption of the milk supply. Should L. M. have continued to excrete bacilli, the excretion by normal carrier being not necessarily as transient as it was in his case, we should have left an unsuspected carrier, who might have been the source of infection for subsequent cases.

Although a positive Widal reaction may be absent in chronic carriers, the results indicate that even if a farm helper is found to be excreting typhoid bacilli, any other individual giving a partial or positive Widal reaction should be held under suspicion. At least, fecal examinations should be made over a period of time, as excretion even with chronic carriers is intermittent and negative examinations are not infrequent, and may extend over months or even for a year.

Summary.—The presence on a farm of a normal carrier and a chronic carrier, temporarily fecal negative, is a possible source of error in tracing the source of infection of a milk-borne epidemic of typhoid fever.

VENTILATION AFTER FUMIGATION.

ARTIFICIAL VENTILATION OF SHIPS AFTER FUMIGATION WITH HYDROCYANIC ACID GAS.

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The spread of bubonic plague to all parts of the world in recent years has emphasized the necessity of improving the means used for the destruction of rats on board ships, as it is through these animals that the disease is transmitted. It has been shown that rats are great travelers, and that they may be found in all parts of a vessel, from the costly saloons of the liner to the deepest hold of the freighter,[1] and consequently that no part of a ship should be excepted when fumigation is done.

[1] Grubbs and Holsendorf, Public Health Reports, June 20, 1913.